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# A Confirmatory Analysis of the Hierarchical Structure of Positive and Negative Dose-Related Alcohol Expectancies in Alcoholics and the Associations with Family History of Alcoholism\*

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**ABSTRACT.** *Objective:* The usefulness of measuring four types of alcohol-outcome expectancies in alcoholics was investigated. *Method:* The investigation was conducted in three steps. First, a measurement model previously fitted in a general population sample was fitted in the present sample of alcoholics, using confirmative factor analysis. In the hierarchical model tested, four types of expectancies are represented as four second-order factors; positive and negative expectancies for a low and for a high dose of alcohol. The model was compared with competing models. Second, a common measurement model was tested for subgroups of alcoholics categorized by gender and family history of alcoholism. Third, using path analysis, the associations were investigated for the four types of expectancies with

variables of potential relevance for treatment. A sample of 451 male and female clinically referred alcoholics volunteered to complete a series of questionnaires, including the expectancy questionnaire. *Results:* Following minor modifications, the measurement model was found to fit adequately in the present sample of alcoholics and across the subsamples. Family history of alcoholism was positively associated with positive expectancies, especially for a high dose of alcohol. This association was mediated by cluster-B personality disorders. *Conclusions:* Even though the expectancy questionnaire used here should be refined in several respects, the results demonstrate the usefulness of measuring four types of expectancies in alcoholics. (*J. Stud. Alcohol* 61: 177-186, 2000)

ALCOHOL OUTCOME EXPECTANCIES have consistently been found to be associated with alcohol consumption in a variety of nonalcoholic samples (e.g., Goldman et al., 1997). Expectancies prospectively predict alcohol consumption in adolescents (Christiansen et al., 1989; Smith et al., 1995) and in young adults (Sher et al., 1996; Stacy et al., 1991). The reverse effect has also been found: expectancies are predicted by the level of alcohol consumption at an earlier point in time (Sher et al., 1996). Relatively few studies of alcohol outcome expectancies have included alcoholics, despite promising findings concerning the prediction of treatment outcome (Brown, 1985; Jones and McMahon,

1994, 1996). In the present study, the usefulness of measuring four types of expectancies in alcoholics is investigated.

## *Expectancies: Four of a kind*

The term *alcohol expectancies* has been used for different concepts in the literature, especially in relation to alcoholism. The distinction between “efficacy expectancies” (Bandura, 1977) and “outcome expectancies” is common, but still different kinds of expectancies have been defined (e.g., Solomon and Annis, 1989). This study deals with alcohol outcome expectancies, defined as anticipated positive or negative reinforcement from drinking alcohol (e.g., Leigh and Stacy, 1993). Outcome expectancies may be subdivided into four types, with respect to valence and dose of alcohol: positive and negative expectancies for both a low dose and a high dose of alcohol (Wiers et al., 1997). To date, most expectancy studies have used versions of the AEQ (Alcohol Expectancy Questionnaire; Brown et al. 1980, 1987a). The AEQ measures only one type of expectancy: positive expectancies for a low to moderate dose of alcohol (most items of the AEQ refer to expected reinforcement after “a few” or “a couple” of drinks, and some items have no dose specification). With more recent instruments, it has been found that negative expectancies contribute uniquely to the prediction of alcohol consumption (Fromme et al., 1993; Leigh and

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Stacy, 1993). Dose-related expectancies have received relatively little attention in the literature. One reason may have been that an early expectancy instrument that differentiated for dose of alcohol (Southwick et al., 1981) suffered from methodological shortcomings and hardly predicted alcohol consumption (Leigh, 1989).

Dose and valence are not independent: conform the bi-phasic response to alcohol, most people expect positive effects for a low dose and negative effects for a high dose of alcohol (Earleywine and Martin, 1993; Fromme et al., 1993). This does not imply that the other two types of expectancies (i.e., negative expectancies for a low dose and positive expectancies for a high dose of alcohol) can be discarded as irrelevant beforehand. A recent study, in which all four types of expectancies were measured with the instrument used here, found that high-dose positive expectancies were highly predictive of a pattern of heavy alcohol use during weekends in secondary school boys of 16 years and older (Wiers et al., 1997).

High-dose expectancies may be particularly relevant to alcoholics. Connors and associates (1987) reported that alcoholics and problem drinkers judged being drunk more beneficial for feeling better, feeling in charge and relieving emotional stress in comparison with social drinkers. Gustafson (1989) reported that alcoholics expected positive emotional changes when drinking "in their habitual mode, that is, in rather large quantities at a single occasion." In addition to positive expectancies, alcoholics may also develop *negative* expectancies for drinking high doses of alcohol, due to negative experiences related to alcohol abuse. Jones and McMahon (1994) developed an instrument to measure negative expectancies (NAEQ), which primarily targeted alcoholics. Although dose is not explicitly specified in this instrument, most expected effects relate to intoxication. Comparing the AEQ and the NAEQ, Jones and McMahon (1994) found that negative, rather than positive, expectancies predicted abstinence after discharge from a residential treatment program. Note that with this combination, measurement is still limited to low-dose positive and high-dose negative expectancies.

### *This study*

The usefulness of measuring the four types of expectancies as defined above in alcoholics was investigated in three steps: First, an expectancy factor structure previously confirmed in a general population sample (Wiers et al., 1997) was fitted to the present sample of alcoholics, using Confirmatory Factor Analysis (CFA). Although such an analysis constitutes a prerequisite for further applications in alcoholics, we are not aware of earlier studies following this procedure. In the hierarchical model tested, the four types of expectancies are conceptualized as correlated second-order factors (Wiers et al., 1997). Second-order models have been advocated, because specific expectancies are hypothesized to be facets of a more general concept (e.g., Goldman et al., 1997). In agreement with the expectancy typology outlined

above, the AEQ has been modeled with one second-order factor (Goldman et al., 1997), and the questionnaire of Leigh and Stacy (1993) has been modeled with two correlated second-order factors. The second-order model tested here was compared with the first-order model under which it is nested, and with competing second-order models.

Second, the stability of the factor-model was tested across subgroups of alcoholics. A series of progressively more restrictive multigroup comparisons were performed across male and female alcoholics with and without an alcoholic parent. The goal of these analyses was to test whether the same factor model could be used across subgroups of alcoholics.

Third, associations between the four types of expectancies and variables of potential relevance to treatment were examined. The rationale behind this procedure was that subgroups of alcoholics could have specific patterns of expectancies, which could be useful in future treatment studies. Associations with the following variables were investigated: family history of alcoholism (FH), age, gender, personality disorders (PDs), severity of alcoholism, age of onset, and treatment history.

A variable of primary interest in these analyses was FH. Individuals with a positive FH (FHPs), such as children of alcoholics, respond more favorably to alcohol than individuals with a negative FH (FHNs). This difference in response has two aspects: FHPs experience more direct positive reinforcement after ingestion of a substantial amount of alcohol and suffer less from later alcohol intoxication than do FHNs (Newlin and Thomson, 1990). Both facets of the individual differences in response to alcohol are likely to become reflected in the alcohol expectancies of FHPs. Indeed, non-alcoholic, drinking FHPs have stronger positive expectancies than do controls, especially for cognitive and motor enhancement (Brown et al., 1987b; Mann et al., 1987; Sher et al., 1991). It is as yet unclear whether nonalcoholic FHPs differ from controls on the other three types of expectancies (these have hardly been investigated) and whether the differences reported are still found between *alcoholic* FHPs and controls. Given the differential response to alcohol, we hypothesized that FHP alcoholics hold stronger positive and weaker negative expectancies than do FHN alcoholics, with the largest difference for high-dose expectancies.

Two other variables were anticipated to be positively associated with FH and to have a similar pattern of associations with the four types of expectancies: Cluster B PDs and an early onset age of alcoholism. Several authors have proposed etiological models in which the familial risk for (early onset) alcoholism is mediated by behavioral undercontrol and related conduct problems, with the latter being a precursor of antisocial PD, part of Cluster B (Gorenstein, 1987; Pihl et al., 1990; Tarter, 1988). The covariation between these variables was modeled in a path analysis in order to investigate the specificity of the observed associations as well as the influence of moderating variables such as age and gender (see Sher and Trull, 1994). The other two PD clusters (Cluster A and Cluster C) were included to test for the specificity of the

associations with Cluster B PDs. No specific hypotheses were made for the associations with Cluster A and Cluster C PDs. Treatment history and severity of alcoholism were added on an exploratory basis.

In summary, the usefulness of measuring four types of alcohol outcome expectancies in alcoholics was investigated in three steps. First, the factor structure was tested and compared with competing models in the entire sample. Second, the factor structure was tested across subsamples differentiated with respect to gender and the presence of an alcoholic parent. Third, associations were explored between the four types of expectancies and variables of potential usefulness to treatment.

## Method

### Participants

Between January 1994 and March 1995 a total of 457 clients meeting DSM III-R (American Psychiatric Association, 1987) criteria for alcohol dependence or abuse volunteered to complete a series of questionnaires. All participants were inpatients or outpatients of the Jellinek Center in Amsterdam for treatment of substance use disorders. Six participants were excluded from further analyses because they had failed to complete four or more of the expectancy items (remaining missing expectancy items were replaced by sample item means). Of the remaining 451 participants, 405 met the criteria for alcohol dependence in the last year; 19 met the criteria for alcohol dependence, not clustered in the last year; and 27 met the criteria for alcohol abuse (all DSM III-R).

Background variables of male and female alcoholics with and without an alcoholic parent are presented in Table 1. Note that the participants were distributed unequally across these categories. A significant difference was found for age

( $F = 11.85$ , 3/447 df,  $p < .001$ ), with Student-Newman-Keuls (SNK) post hoc tests indicating that FHP alcoholics were significantly younger than FHN alcoholics. A significant difference was also found for age of onset ( $F = 8.45$ , 3/446 df,  $p < .001$ ). The SNK tests indicated that female FHN alcoholics had a later mean onset age than all other groups, and male FHN alcoholics had a later age of onset than male and female FHP alcoholics. Women were outpatients significantly more often than were men ( $\chi^2 = 6.3$ , 1 df,  $p = .012$ ), and FHP alcoholics received earlier treatment less often than did FHN alcoholics ( $\chi^2 = 3.9$ , 1 df,  $p = .049$ ).

### Materials

**Alcohol use disorders.** Alcohol use disorders were assessed with the Composite International Diagnostic Interview (CIDI; Robins et al., 1988), a comprehensive fully structured interview.

**Expectancies.** A Dutch questionnaire was used that had been developed to measure four types of alcohol outcome expectancies: positive and negative expectancies for both a low and a high dose of alcohol (see Figure 1; see also Wiers et al., 1997).

**Demographic and alcohol-related variables.** Demographic variables presented in Table 1 were assessed with the EuropASI, the European adaptation (Kokkevi and Hartgers, 1995) of the fifth edition of the Addiction Severity Index (McLellan et al., 1980). Several alcohol-related variables were assessed with the EuropASI: treatment history (first alcoholism treatment or not, including self-help groups and Alcoholics Anonymous), age of onset of heavy drinking, severity of alcoholism (rated by the interviewer) and FH. Family history was defined at two levels: a broad distinction was made between participants with and without an alcoholic parent (used in the multigroup analyses of the measurement model), and a more fine-grained FH measure was used in the path analysis: 0 = no first- or second-degree alcoholic relatives; 1 = second-degree but no first-degree alcoholic relatives; 2 = first-degree but no second-degree alcoholic relatives; 3 = first- and second-degree alcoholic relatives (similar to Dawson et al., 1992).

**Personality disorders (PDs).** PDs were measured with a Dutch translation of the Personality Disorders Questionnaire-Revised (PDQ-R; Hyler and Reider, 1984), a self-report instrument to measure DSM-III-R PDs. Note that the prevalence of PDs measured in self-report instruments is higher than in semistructured interviews (Verheul et al., 1998). The three cluster scores were used: Cluster A (paranoid, schizoid, schizotypal PDs), Cluster B (antisocial, borderline, histrionic, narcissistic PDs) and Cluster C (avoidant, dependent, obsessive-compulsive, passive-aggressive PDs).

### Procedure

All participants signed informed consent. At intake, trained interviewers administered the EuropASI. During the second to fourth week of treatment, clients received the

TABLE 1. Sample characteristics per subgroup defined by gender and alcoholic parent

	FHN Males	FHP Males	FHN Females	FHP Females
<i>n</i>	227	105	77	42
Age	43.0 ± 9.9	38.9 ± 8.4	43.9 ± 8.1	36.0 ± 8.2
Born in the				
Netherlands (%)	183 (81%)	95 (91%)	69 (90%)	35 (83%)
Living alone (%)	165 (79%)	87 (83%)	54 (72%)	31 (74%)
No current job (%)	123 (58%)	57 (55%)	48 (64%)	30 (71%)
Inpatient (%)	140 (62%)	57 (54%)	57 (74%)	29 (69%)
Previous				
treatment (%)	121 (62%)	56 (55%)	48 (68%)	20 (49%)
Level of				
education (1-3)	1.79 ± 0.71	1.75 ± 0.75	2.01 ± 0.74	1.77 ± 0.73
Years of education	11.9 ± 3.6	12.3 ± 3.6	12.1 ± 3.6	12.2 ± 3.5
Age on onset	30.7 ± 10.8	27.6 ± 8.9	34.9 ± 10.4	28.2 ± 9.8
Severity index	5.9 ± 1.1	5.9 ± 1.2	5.6 ± 1.2	6.1 ± 0.9

Notes: For the dichotomous variables the number is given with the percentage in parentheses, and for the continuous variables the mean is given with the standard deviation. The percentages given are the percentages of the nonmissing data. FHP = family history positive (here defined as having an alcoholic parent); FHN = family history negative (here defined as no alcoholic parent).

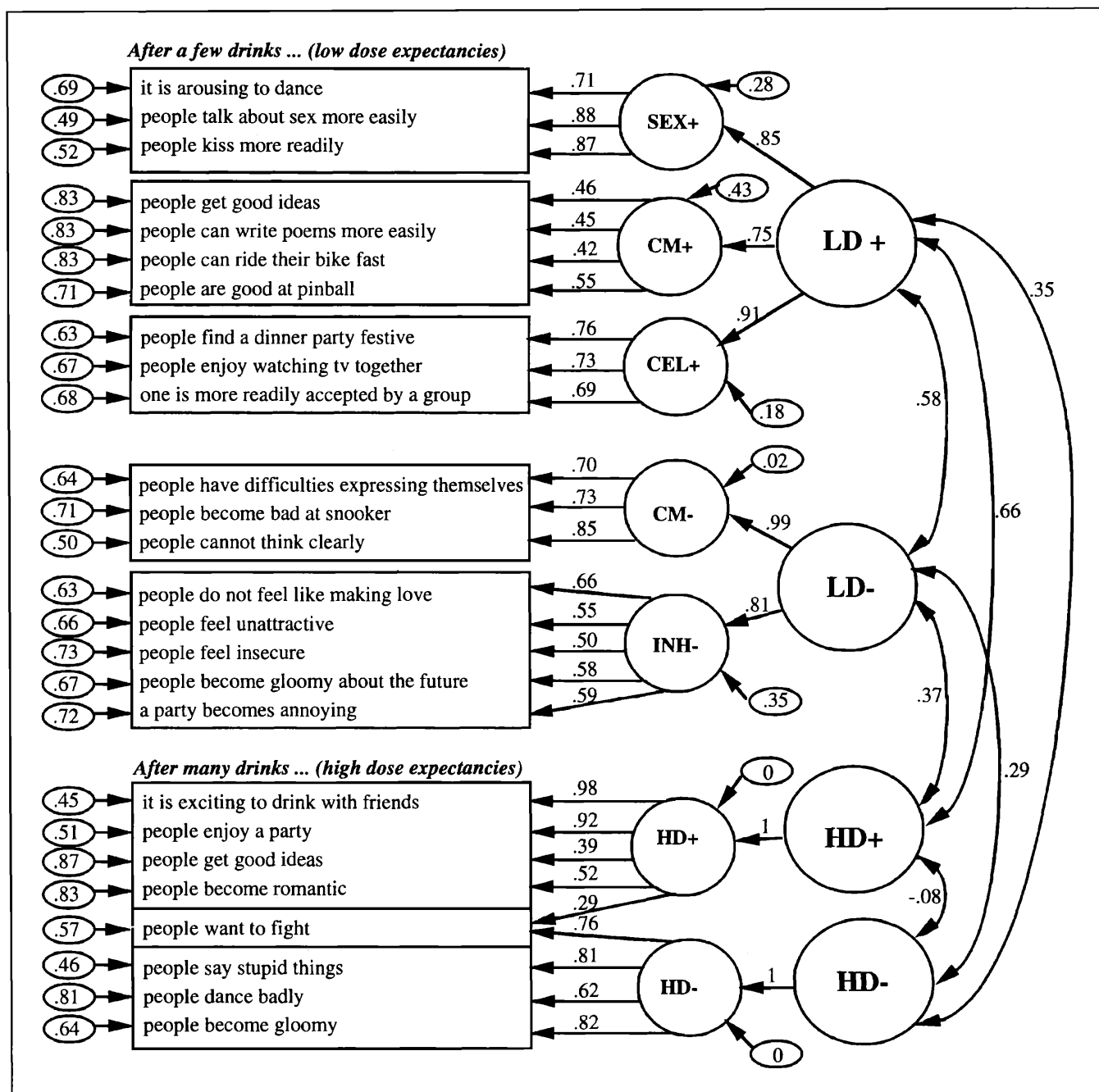


FIGURE 1. The model presented is the hierarchical measurement model with four second-order factors (see Model 3, Table 2). The parameters are taken from the standardized solution of the single-group analysis. The small ellipses to the left denote the residual variances of the observed variables. Three of these were allowed to correlate (not shown here). The rectangles contain the expectancy items, the observed variables. The seven medium-sized circles in the middle denote the first-order factors. These were not allowed to correlate directly. The four larger circles to the right denote the four second-order factors. These were allowed to correlate. All parameter values were significant at the .05 level, except one residual of a first-order factor (cognitive motor impairment). SEX+ = sexual enhancement; CM+ = cognitive and motor enhancement; CEL+ = celebration, group acceptance; LD+ = low-dose positive expectancies; CM- = cognitive and motor impairment; INH- = inhibition, negative mood; LD- = low-dose negative expectancies; HD+ = high-dose positive expectancies; HD- = high-dose negative expectancies.

expectancy questionnaire and the PDQ-R. Extensively trained research assistants administered the CIDI during this period.

#### Statistical analyses

All CFAs and the path analysis were done with LISREL 8 (Jöreskog and Sörbom, 1993a). Maximum Likelihood esti-

mation was applied to the covariance matrices. Details concerning the models tested are given below. In the measurement models, the data were centered within each of the four subgroups to prevent distortion of the factor structure due to possible mean differences. A path analysis using observed variables rather than latent variables was performed to investigate the covariance structure of the four types of

expectancies and the other variables of interest. The reason was that this more conservative strategy better suited the exploratory nature of this part of the analyses and the number of participants in relation to the number of variables used.

## Results

### *Measurement model: Entire sample*

In the first step, a series of restrictive factor models were fitted to the entire sample of alcoholics. The first model fitted was one without second-order factors (i.e., no structure was specified for the seven correlated first-order factors). The fit was modest ( $\chi^2 = 641.2$ , 278 df), as also indicated by the fit indices: RMSEA = .054 and CFI = .86. (RMSEA values below .05 and CFI values above .95 indicate a close fit of the model to the data; see Jöreskog and Sörbom, 1993b.) Modification indices (Jöreskog and Sörbom, 1991) indicated that the errors of three item-pairs were correlated. Estimation of these correlations was judged acceptable because the three item-pairs concerned similar effects for a low and for a high dose of alcohol. The items were: "after a few drinks people have difficulty expressing themselves" with "after many drinks people say stupid things"; "after a few drinks people become bad at snooker" with "after many drinks people dance badly"; and "after a few drinks people get good ideas" with "after many drinks people get good ideas." Modification indices further indicated that one high-dose negative expectancy ("people want to fight after many drinks") had high modification indices on all positive scales. The second adjustment to the model was that this item was allowed to cross-load on positive high-dose expectancies, next to the primary loading on negative high-dose expectancies. The modified model fitted significantly better:  $\chi^2 = 514.6$ , 274 df, RMSEA = .044, CFI = .90; chi-square difference test (Long, 1983)  $\Delta\chi^2 = 126.6$ , 4 df,  $p < .001$ . This slightly adjusted model (see Model 2, Table 2) was accepted as fitting the data reasonably well.

Next, the same second-order factor structure, as specified in Wiers et al. (1997), was added to the adjusted first-order factor model (see Figure 1). Note that in this model the two second-order factors representing high-dose expectancies

are in fact equivalent to first-order factors. The reason for this conceptualization is that the questionnaire consists of a relatively small number of high-dose items, which makes it impossible to discern more specific aspects of the high-dose expectancies. However, from a theoretical perspective, the two high-dose factors are better conceptualized as second-order factors correlated with the two low-dose second-order factors, than with specific low-dose first-order factors. As a test of discriminant validity, this theoretically based model was compared with two competing second-order models.

Testing the model with four second-order factors resulted in an acceptable fit:  $\chi^2 = 569.5$ , 284 df, RMSEA = .047, CFI = .89 (see Model 3, Table 2). A second-order model may be anticipated to fit less well than the first-order model under which it is nested, because additional constraints are imposed on the pattern of correlations of the first-order factors. However, a second-order factor model is useful because it allows one to define more global factors without residual errors, which allows for a better prediction of dependent variables (see Goldman et al., 1997; Wiers et al., 1997). The fit of the *higher order portion* of the model may be evaluated by inspecting the TC2 coefficient (Marsh, 1987; see also Goldman et al., 1997): in case of values above .90, the fit of the second-order portion is judged acceptable. The fit of the second-order portion of the model tested here was good (.98), indicating that 98% of the covariance among the first-order factors was accounted for by the second-order factor structure.

As a comparison, two models were tested with only two second-order factors. In the first of these competing models, only positive and negative expectancies were distinguished (irrespective of dose; see Model 4, Table 2); in the second, expectancies were distinguished with respect to dose only (irrespective of valence; see Model 5, Table 2). The fit of both models was acceptable in terms of fit indices, but both models fitted the data significantly less well than did the model with four second-order factors ( $\Delta\chi^2_{\text{Model 3 vs Model 4}} = 34$ , 3 df,  $p < .001$ ;  $\Delta\chi^2_{\text{Model 3 vs Model 5}} = 88.8$ , 3 df,  $p < .001$ ) and showed somewhat poorer fit indices (see Table 2).

For three reasons, Model 3 was selected for further analyses. First, it confirmed the theoretical distinction between the four types of expectancies. Second, it fitted better than did

TABLE 2. Goodness-of-fit indices for complete group comparison of first- and second-order single-group models

Model <sup>a</sup>	df	$\chi^2$	RMSEA	ECVI	CFI	AIC	TC2
1. First-order model ( $n = 451$ )	278	641.2	.054	1.75	.86	787.2	—
2. First-order model adj.	274	514.6	.044	1.49	.90	668.6	—
3. Second-order model ( $nk = 4$ )	284	569.5	.047	1.56	.89	703.5	.98
4. Second-order model pos-neg ( $nk = 2$ )	287	603.5	.050	1.63	.87	731.5	.95
5. Second-order model low-high dose ( $nk = 2$ )	287	658.3	.054	1.75	.85	786.3	.94

<sup>a</sup>Numbers refer to models in this table and as cited in article text.

Notes:  $nk$  = number of second-order factors. Adj. = adjusted model (three correlated errors and one secondary factor loading; see text). Fit indices: RMSEA = Root Mean Square Error of Approximation; ECVI = Expected Cross-Validation Index; CFI = Comparative Fit Index; AIC = Akaike Information Criterion (all described in Jöreskog and Sörbom, 1993b); TC2 = Target Coefficient 2 (Marsh, 1987), which evaluates the higher order portion of a second-order model in comparison with a first-order model.

competing second-order models. Third, it adequately explained the covariance among first-order factors (98%). The accepted measurement model (Model 3, Table 2) is depicted in Figure 1. All first- and second-order factor loadings were significant, all residuals of the observed variables were positive and significant, and all residuals of the first-order factors were positive (one was not significant: the residual of cognitive motor impairment). The parameter estimations may be found in Figure 1. The squared multiple correlations of all observed variables were greater than .10.

*Measurement model across subgroups (gender and family history)*

As a second step in the analyses of the measurement model, the same set of models was tested across subgroups of the sample, differentiated with respect to two independent variables: the presence or absence of an alcoholic parent (global indicator of FH) and gender. The first set of analyses concerned single-group analyses on subsamples as a prerequisite for subsequent multigroup analyses (Byrne et al., 1989). Given the unequal distribution of the sample across the four cells, it was decided to first separately analyze the sample with respect to the two variables. These analyses are by design statistically dependent, because the same sample is split twice according to a different criterion. However, this solution was judged the most powerful way to detect potential model misspecifications related to gender or FH. The pattern of results of these analyses was similar to results reported for the complete sample: the adjustments to the first-order factor structure described above resulted in a better fit than the first-order model without these adjustments, the higher-order portion of the second-order model was acceptable, and fitted better than the competing models with two second-order factors (detailed accounts of these four series of analyses are available upon request). In the two smaller subsamples (female alcoholics and FHP alcoholics), some problems occurred with respect to the residuals of certain first-order factors: some were (nonsignificantly) negative. The same problem occurred in the next series of analyses and is discussed there.

Next, the final second-order model (Figure 1) was fitted *simultaneously to all four subgroups*, male and female alcoholics with and without an alcoholic parent. A hierarchical series of progressively more stringent equivalencies was tested (Jöreskog and Sörbom, 1991): each subsequent model was a more stringent special case of the previous model, with extra invariances specified across the subgroups. The fit of these restricted multigroup models may be anticipated to be poorer than the single-group models described above, because far more restrictions are imposed on the data (invariances across subgroups). However, this multigroup analysis provides the most stringent test of factor equivalence across subgroups of alcoholics.

The multigroup analyses commenced with a model without constraints on the parameters (null model; Byrne et al., 1989). In this model, all parameters are estimated separately for each subgroup (four small independent subsamples). As in the single-group analyses, some of the residuals of the first-order factors had to be fixed at zero: one in FHP men (celebration), one in FHN women (inhibition), and three in FHP women (cognitive motor impairment, celebration and sexual enhancement). The difference between the model without residuals fixed at zero (Model 1, Table 3) and the model with residuals fixed at zero (Model 2, Table 3) was not significant ( $\Delta\chi^2 = 7.8$ , 5 df,  $p = .17$ ), confirming the nonsignificance of these residuals.

It may be questioned how these zero residuals should be interpreted. Note that two residuals are already specified at zero in the present model, because the two high-dose expectancies were not further differentiated. If all other five residuals of the first-order factors would be fixed at zero, the model would reduce to a first-order four-factor model. Given the nonsignificance of the negative residuals, it may be concluded that there were no severe misspecifications in each of the four subgroups at the level of the second-order factors, but that the first-order factor structure may have been slightly overspecific in the smaller subsamples.

The adjusted model was further constrained to have equal factor loadings across the four groups (both first- and second-order factor loadings). The fit of this model (Model 3, Table 3) was significantly poorer than the fit of Model 2, with respect to the

TABLE 3. Goodness-of-fit indices for multigroup analyses (four groups) of different versions of the second-order model

Model <sup>a</sup>	df	$\chi^2$	RMSEA	ECVI	CFI	AIC
1. Second order model (nk = 4), 4 groups	1,136	1,768.0	.070	5.15	.79	2,304
2. Model 1 adj. (5 first-order residuals 0)	1,141	1,775.8	.070	5.15	.78	2,302
3. Model 2 + factor loading equivalent	1,222	1,896.9	.070	5.06	.77	2,261
4A. Model 3 + errors obs. variables equivalent	1,309	2,048.0	.072	5.01	.75	2,238
4B. Model 3 + factor correlations equivalent	1,240	1,928.4	.070	5.05	.77	2,256
5. Parallel equivalence (constraints 4A + B)	1,327	2,075.9	.072	4.99	.75	2,230

<sup>a</sup>Numbers refer to models in this table and as cited in article text.

Notes: nk = number of second order factors. Adj. = adjusted model (explained in text). Fit indices: RMSEA = Root Mean Square Error of Approximation (corrected for multigroup analyses by multiplying with the square root of the number of groups); ECVI = Expected Cross-Validation Index; CFI = Comparative Fit Index; AIC = Akaike Information Criterion (all described in Jöreskog and Sörbom, 1993b).

chi square ( $\Delta\chi^2 = 121, 81$  df,  $p = .003$ ), but several fit indices indicated a *better* fit of this model to the data (AIC, ECVI; see Jöreskog and Sörbom, 1993b). In comparing complex multi-group models, the parsimony of more constrained models is better reflected in these fit indices than in the chi-square or chi-square difference test (Jöreskog, 1993). In addition, the modification indices for all factor loadings in all subgroups were relatively small, indicating that little was to be gained by making specific modifications to the structure of the factors in a subgroup. Group-specific changes were judged undesirable because of the resulting capitalization on chance (MacCallum et al., 1992). Hence, the fit of Model 3 was judged acceptable, given the large number of constraints imposed.

In two subsequent steps, the model was further constrained in two alternative ways: by constraining the errors of the observed variables to be equal across all groups (Model 4A, Table 3), and by constraining the correlations between the four latent second-order factors to be equivalent across the subgroups (Model 4B, Table 3). Both models showed a significant deterioration in fit in comparison with Model 3 ( $\Delta\chi^2_{\text{Model 3 vs Model 4A}} = 151, 87$  df,  $p < .001$ ;  $\Delta\chi^2_{\text{Model 3 vs Model 4B}} = 31.5, 18$  df,  $p = .025$ ). The most stringent model combined the constraints of Models 4A and 4B: all parameters were constrained to be equal across subgroups, except the residuals of the first-order factors ("Parallel Equivalence," Model 5, Table 3). This very stringent model showed a significant deterioration in fit compared with the model with only the factor loadings constrained ( $\Delta\chi^2_{\text{Model 3 vs Model 5}} = 179, 105$  df,  $p < .001$ ), but still showed a reasonable fit as indicated by the fit indices. It may be concluded that a comparison at the level of the four types of expectancies is justified, even though the underlying first-order structure may be slightly overspecific in the small subsamples.

#### Associations with other variables

The associations between the four types of expectancies and the variables of potential relevance to treatment were

calculated using the maximum number of participants available, depending on the number of missing values for each variable (ranging from 0 to 23). The results are presented in Table 4. The four types of expectancies were not significantly associated with gender, age or the number of previous treatments. The highest correlations with the expectancies were found for the scores on the self-reported clusters of PDs. As hypothesized, Cluster B PDs were positively associated with positive expectancies, and most strongly with positive expectancies for a high dose of alcohol. However, these associations were not very specific, given the substantial positive correlations with the other two clusters of PDs. Unexpectedly, Cluster B PDs were positively and not negatively correlated with negative expectancies.

The association was confirmed between FH and positive expectancies for a high dose of alcohol. No significant associations were found with the other types of expectancies. The hypothesized associations between FH and other variables were also confirmed: a negative correlation with age of onset of alcoholism ( $r = -.20, p < .001$ ) and a positive correlation with Cluster B PDs ( $r = .21, p < .001$ ). Again, the association with PDs was not specific: FH also correlated significantly with Cluster A PDs ( $r = .18, p < .001$ ) and with Cluster C PDs ( $r = .17, p < .01$ ).

The covariation of FH, the three PD clusters, age of onset and the four types of expectancies were modeled in a path analysis. In this analysis only those participants were included who had no missing data on all of the 11 variables of interest ( $n = 409$ ). The direction of causal relations were based on the etiological models found in the literature (see introduction), but cannot be established in the present cross-sectional study. In the model tested, FH and the two moderators age and gender were specified as exogenous variables. The scores on the three PD clusters and age of onset were modeled as correlated mediating variables and the four types of expectancies as correlated outcome variables. The fit of the model was good ( $\chi^2 = 13.8, 14$  df,  $p = .47$ ). Note that the much better fit obtained here in comparison with the analyses of the measurement model was expected because in the

TABLE 4. Correlations (PMCCs) between the four types of expectancies and other variables

	Gender	Age	T-Hist	FH	Onset	Sever	PD-A	PD-B	PD-C
LDPOS	.04	.03	-.01	.08	-.01	.01	.25*	.30*	.25*
LDNEG	-.01	.09	-.02	-.01	.15*	-.11*	.21*	.15*	.18*
HDPOS	-.02	-.01	.06	.12*	-.01	.07	.25*	.36*	.20*
HDNEG	.04	.00	.00	.06	.01	-.10*	.08*	.13*	.16*

\* $p < .05$ . † $p < .01$ . ‡ $p < .001$ .

Notes: LDPOS = positive expectancies for a low dose; LDNEG = negative expectancies for a low dose; HDPOS = positive expectancies for a high dose; HDNEG = negative expectancies for a high dose (items and factor structure of expectancies; see Figure 1). T-Hist = treatment history; FH = family history of alcoholism (0-3); Onset = age of onset of heavy drinking (EuropASI); Sever = severity of alcoholism (EuropASI); PD-A = self-reported dimensional score on personality disorders (PDs) of the A-cluster (paranoid, schizoid, schizotypal PDs); PD-B = self-reported dimensional score on PDs of the B-cluster (antisocial, borderline, histrionic, narcissistic PDs); PD-C = self-reported dimensional score on PDs of the C-cluster (avoidant, dependent, obsessive-compulsive, passive-aggressive PDs).



path model no latent variables were specified. Hence, in this case the  $p$  value is more informative than the fit indices (which all had optional values here): a nonsignificant  $p$  value indicates that the proposed structure adequately explains the covariance structure between the observed variables. The

path model with standardized regression weights is shown in Figure 2.

Three indirect effects were significant: from FH to positive expectancies, both for a low and a high dose of alcohol, and from age on low-dose negative expectancies. Cluster B

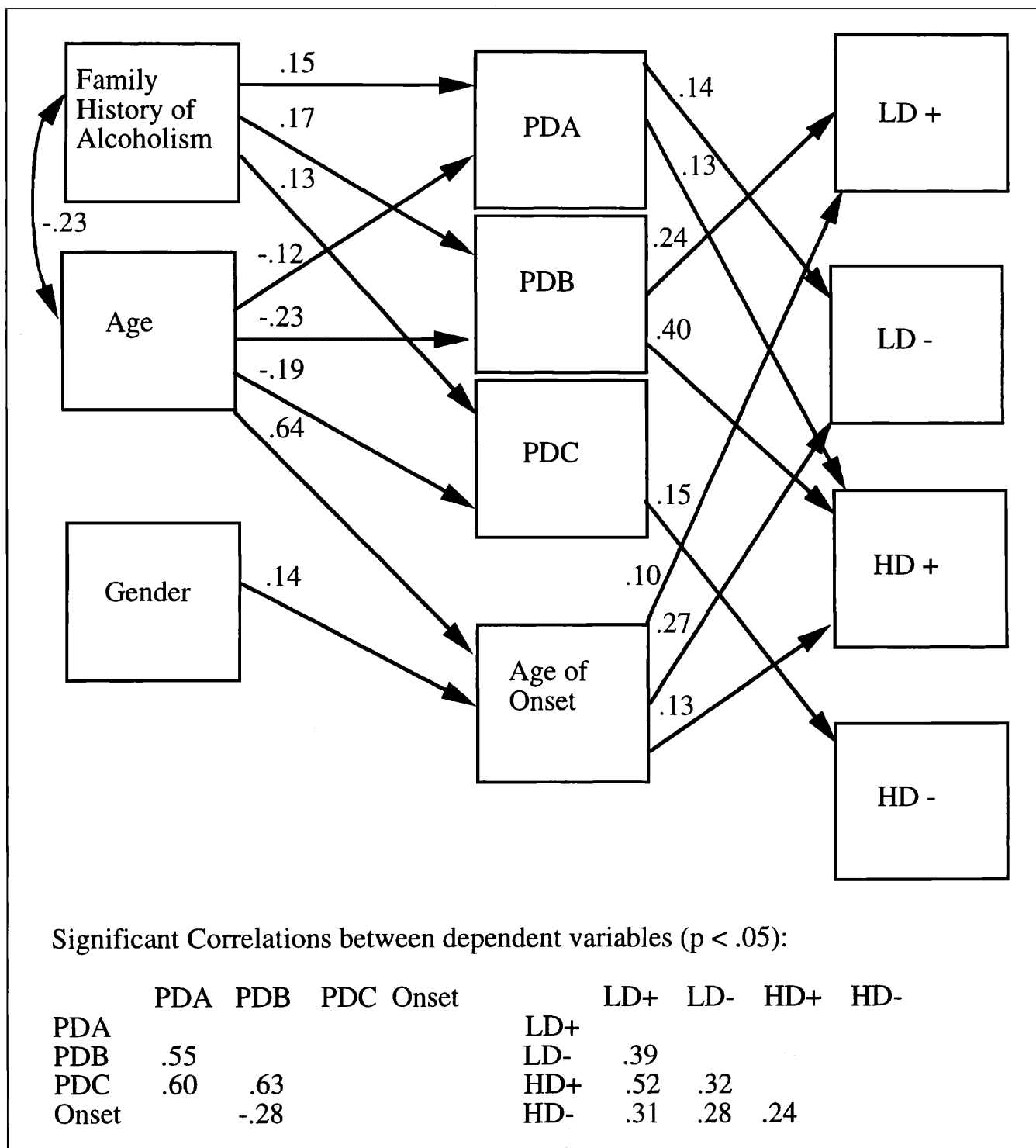


FIGURE 2. Path model concerning the covariation of several variables with alcohol expectancies. All values shown are standardized estimates. Only paths that are significant at the .05 level are depicted. Legend: PDA, PDB and PDC are the scores on the three personality disorder clusters (A, B and C), as measured with the PDQ-R. LD+ = low-dose positive expectancies; LD- = low-dose negative expectancies; HD+ = high-dose positive expectancies; HD- = high-dose negative expectancies.

PDs were a strong predictor of high-dose positive expectancies and fully mediated the effect of FH on both types of positive expectancies. Explained variances were 10% (adjusted  $R^2 = 8\%$ ) for low-dose positive expectancies and 16% (adjusted  $R^2 = 14\%$ ) for high-dose positive expectancies. Negative expectancies for a low dose were significantly predicted by Cluster A PDs, age of onset, and indirectly by age, with an explained variance of 12% (adjusted  $R^2 = 10\%$ ). The percentage explained variance for negative expectancies for a high dose was low (3%; adjusted  $R^2 = 1\%$ ), with Cluster C PDs as the only significant predictor. The results of the path analysis confirmed the hypothesized associations between FH, Cluster B PDs and positive expectancies, but the hypothesized associations with negative expectancies were not confirmed.

### Discussion

The usefulness of measuring four types of alcohol outcome expectancies in alcoholics was investigated in three steps. In the first step, the factor structure found in a previous general population sample was tested in the present sample of clinically referred alcoholics. After minor modifications, the hierarchical factor structure was confirmed. The second-order part of the model, representing the four types of expectancies, fitted well and accounted for 98% of the covariance between the first-order factors. The proposed model fitted significantly better than competing models with only two second-order factors.

The second step concerned a series of multigroup analyses, in which it was tested whether the hierarchical factor structure was confirmed across subgroups of alcoholics differentiated with respect to gender and the presence of an alcoholic parent. This was the case. A problem encountered in these analyses was that some residuals of first-order factors were estimated to have small negative values. As a solution these were fixed at zero, and the resulting fit did not significantly differ from the original fit, confirming the nonsignificance of these residuals. Hence, the first-order factor structure might have been slightly overspecific in some subgroups, but factor equivalence was confirmed at the level of the four types of expectancies.

In the third step, associations of the four types of expectancies were explored with a number of other variables of potential relevance to treatment. Family history of alcoholism was significantly associated with positive expectancies for a high dose of alcohol. The largest correlations with expectancies were found for personality disorders of all three clusters. Although this suggested a lack of specificity, more specific associations were found in a subsequent path analysis. Cluster B PDs were most strongly associated with positive expectancies, especially with those for a high dose of alcohol. The effect of FH on positive expectancies was significantly mediated by Cluster B PDs.

What follows from these findings concerning future treatment studies? The strong positive expectancies for a high

dose of alcohol FHP alcoholics, or alcoholics with Cluster B PDs, may reflect a biologically based difference in the reward experienced when drinking high doses of alcohol (Giannoulakis et al., 1996; Peterson et al., 1996). It could be investigated whether specific treatments are beneficial in this subgroup, such as pharmacotherapy reducing rewarding effects of alcohol or a cognitive behavioral challenge of positive expectancies for a high dose. Additional research concerning measurement of four types of expectancies in alcoholics is needed first.

Although this study has demonstrated the potential usefulness of measuring four types of expectancies in alcoholics, the instrument employed has several limitations. Firstly, high-dose expectancies were included on an exploratory basis with relatively few items. Future instruments should include more specific high-dose expectancies, allowing for a more differentiated factor structure at the level of first-order factors. Secondly, we believe the present conceptualization of negative expectancies for a high dose of alcohol is not optimal and may have been responsible for the poor associations with other variables. More distal negative expectancies such as the ones measured with the NAEQ (Jones and McMahon, 1994) may constitute an appropriate extension. A third potential limitation of the present instrument is that the items were stated with reference to people in general, which might not be the ideal format for alcoholics (Leigh, 1989; but see Gustafson and Engström, 1991).

In conclusion, the results of the present day study suggest that measuring positive and negative expectancies for a low and for a high dose of alcohol is a promising option for future research with alcoholics. The neglected positive expectancies for a high dose of alcohol appear to be especially relevant to a subgroup of alcoholics, characterized by Cluster B PDs and a family history of alcoholism.

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